PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Mary Chen	)	Examiner: Jackson Jr, Jerome
		)	
		)	Art Unit: 2815
Serial No.:	10/776,862	)	
		)	Our Ref: B-4967NP 621679-8
Filed:	February 10, 2004	)	
		)	
For:	"A Semiconductor Structure ..."	)	
		)	
		)	

DECLARATION UNDER 37 C.F.R. §1.131

I, Mary Chen, declare and say:

1. I am an inventor in the above-identified application.

2. I conceived the invention claimed in the above-identified application no later than October 14, 2002, on which date the invention was first disclosed to a colleague, Marko Sokolich. This invention was first memorialized in a written document on October 14, 2002.

4. Proof for the above is evidenced by the Invention Disclosure document attached hereto, signed and witnessed on November 1, 2002.

6. The invention was forwarded to a patent attorney at Ladas and Parry, LLC on February 11, 2003, proof for which is evidenced by the cover letter, attached hereto, that accompanied the Invention Disclosure document when it was forwarded to Ladas and Parry, LLC.

7. I met with the patent attorney from Ladas and Parry, LLC on February 28, 2003 to discuss the subject matter of the Invention Disclosure document. This is evidenced by page 3 of the Timekeeper Record from Ladas and Parry, LLC, attached hereto.

8. I submit that I diligently worked with the patent attorney from Ladas and Parry, LLC from February 28, 2003 until the filing date of the provisional application on August 12,

2003. This is evident by pages 1-2 of the Timekeeper Record from Ladas and Parry, LLC, attached hereto.

9. A copy of an email dated April 11, 2003 is enclosed herein to show that I, the inventor, received and provided comments to the first draft of the application prepared by the patent attorney from Ladas and Parry, LLC.

10. Copies of emails dated April 14, 2003 and April 21, 2003 are enclosed herein to show that I, the inventor, provided additional comments to the first draft of the application prepared by the patent attorney from Ladas and Parry, LLC.

11. A copy of a Transmission Report dated May 23, 2003 is enclosed herein evidencing that a seven (7) page fax with invention drawings were forwarded from the patent attorney to me, the inventor, for review.

12. A copy of a Communication Result Report dated June 20, 2003 is enclosed herein evidencing that a thirty-one (31) page fax with 2nd draft of the application were forwarded from the patent attorney to me, the inventor, for review.

13. A copy of the cover page dated July 3, 2003 is enclosed herein evidencing that a 3rd draft of the application was forwarded from the patent attorney to me, the inventor, for review.

14. A copy of an email dated July 8, 2003 is enclosed herein to show that I, the inventor, provided additional comments to the application prepared by the patent attorney from Ladas and Parry, LLC.

15. A copy of a Transmission Report dated August 4, 2003 is enclosed herein evidencing that a twenty-seven (27) page fax with Final Draft of the provisional application were forwarded from the patent attorney to me, the inventor, for review.

16. A copy of a Transmission Report dated August 6, 2003 is enclosed herein evidencing that a twenty-eight (28) page fax with Updated Final Draft of the provisional application were forwarded from the patent attorney to me, the inventor, for review.

17. A copy of an email dated August 12, 2003 is enclosed herein to show that a representative of HRL, i.e. Dan Allemeier, provided non-technical comments to the patent attorney prior to the filing of the provisional application on August 12, 2003.

18. I declare further that all statements made herein of my own knowledge are true; that all statements made herein on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patents issuing thereon.

Date: 10/3/2006

Mary J. Chen
Mary Chen

Enclosures: Invention Disclosure (10 pages);
Cover letter that accompanied the Invention Disclosure document when it was forwarded to Ladas and Parry, LLC;
Pages 1-3 of the Timekeeper Record from Ladas and Parry, LLC;
Copy of an email dated April 11, 2003;
Copy of an email dated April 14, 2003;
Copy of an email dated April 21, 2003;
A copy of a Transmission Report dated May 23, 2003;
A copy of a Communication Result Report dated June 20, 2003;
A copy of the cover page dated July 3, 2003;
A copy of an email dated July 8, 2003;
A copy of a Transmission Report dated August 4, 2003;
A copy of a Transmission Report dated August 6, 2003; and
A copy of an email dated August 12, 2003.

TECHNOLOGY INFORMATION OFFICE
ATTN: Joy Pavlow, MS RL55
HRL LABORATORIES, LLC
Telephone No. - 5734

HRL PROPRIETARY AND SENSITIVE
(when completed)

INVENTION DISCLOSURE

THIS INVENTION DISCLOSURE IS MADE PURSUANT TO MY / OUR OBLIGATIONS TO HRL LABORATORIES, LLC

HRL LABORATORIES

1. TITLE

InP Based NPN HBT Passivated with Thin Depleted Emitter Ledge

2. INVENTOR(S)

Name	Payroll No. or Organization	Source Code/Loc/Bldg/MS or Address for Non HRL Inventor	Citizenship	Phone	Manager
Mary Chen	J3217	30-31-70 MA/254/4C23 254 RL61A	U.S.	310-317-5736	Marko Sokolich

LOSS OF RIGHTS THROUGH RELEASE TO THE PUBLIC

The right to apply for and obtain a valid patent may be lost as the result of certain activities, such as (1) disclosing the invention outside of the company without an appropriate confidentiality agreement with the receiving party; (2) disclosing the invention publicly by publication in a journal, presentation, magazine or otherwise; (3) using the invention publicly; (4) using the invention privately to build or test items that are to be sold publicly; or (5) putting the invention "on sale" by selling or offering for sale an item or product that embodies or uses the invention, or is made or tested by use of the invention. Submitting a proposal with the intent to use the invention in the performance of a resulting contract puts the invention "on sale".

Please inform the HRL General Counsel immediately of any of these activities or any plans to undertake any of them.

INVENTION DOCKET NO.
RECEIVED
HRL LABORATORIES, LLC
NOV 4
021101

TECHNOLOGY INFORMATION OFFICE
ATTN: Joy Pavlow, MS RL55
HRL LABORATORIES, LLC
Telephone No. - 5734

HRL PROPRIETARY AND SENSITIVE
(when completed)

INVENTION DISCLOSURE

THIS INVENTION DISCLOSURE IS MADE PURSUANT TO
MY / OUR OBLIGATIONS TO HRL LABORATORIES, LLC

HRL LABORATORIES

3. PROOF OF CONCEPTION *ALL EVIDENCE OF CONCEPTION (FIRST DRAWING AND FIRST WRITTEN DESCRIPTION) AND EVIDENCE OF REDUCTION TO PRACTICE (DEVICE EMBODYING THE INVENTION AND TEST DATA) MUST BE RETAINED.*

	DATE	TIME SPENT	ACCT. CHARGED	LOCATION OF FIRST DESCRIPTION/DRAWING
A BY WHOM WAS FIRST DESCRIPTION WRITTEN OR DRAWING MADE? Mary Y. Chen	10/14/2002	one week	BC22313701	Lab SR Noteboob S0308

B TO WHOM WAS INVENTION FIRST DISCLOSED? Marko Sokolich	DATE 10/14/2002

4. REDUCTION TO PRACTICE

A WAS A DEVICE EMBODYING THE INVENTION CONSTRUCTED AND TESTED OR THE PROCESS PRACTICED? ○ Yes ◉ No	BY WHOM	DATE STARTED	DATE COMPLETED	TIME SPENT	
B ACCOUNT CHARGED - TIME	ACCOUNT CHARGED - MATERIAL	PRESENT LOCATION OF DEVICE			
C PRESENT LOCATION OF DOCUMENTS (DATE SIGNED AND WITNESSED), INCLUDING PHOTOS, DRAWINGS, AND DATA SHEETS SHOWING REDUCTION TO PRACTICE:					

5. RELATION TO GOVERNMENT CONTRACT

A DOES THIS INVENTION RELATE TO WORK PERFORMED UNDER A GOVERNMENT CONTRACT? ◉ Yes ○ No		CONTRACT NUMBER AND TITLE
B EXPLAIN HOW THIS INVENTION RELATES TO A GOVERNMENT CONTRACT:	It could be usde in TFAST if suitable	
C IS INVENTION BEING USED ON A GOVERNMENT CONTRACT? ○ Yes ◉ No		CONTRACT NUMBER AND TITLE

Mary Chen 11/01/02 SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE

RECEIVED
INVENTION DOCKET NO.
HRL LABORATORIES, LLC
021101

READ AND UNDERSTOOD BY:

David Chow WITNESS NAME (TYPE)	David W. Chow 11/1/02 SIGNATURE DATE	MARKO SOKOLICH WITNESS NAME (TYPE)	SIGNATURE DATE 11/1/02

TECHNOLOGY INFORMATION OFFICE
ATTN: Joy Pavlow, MS RL55
HRL LABORATORIES, LLC
Telephone No. - 5734

HRL PROPRIETARY AND SENSITIVE
(when completed)

INVENTION DISCLOSURE

THIS INVENTION DISCLOSURE IS MADE PURSUANT TO MY / OUR OBLIGATIONS TO HRL LABORATORIES, LLC

HRL LABORATORIES

6. RELATED DOCUMENTS AND DISCLOSURES (BY YOU OR BY ANOTHER). PLEASE ATTACH COPY.

		DATE	IDENTIFY
A IS THERE A PUBLICATION OR PUBLIC PRESENTATION RELATED TO THE INVENTION?	○ Yes ◉ No		
B ARE THERE ANY RELATED INVENTION DISCLOSURES OR PATENT APPLICATIONS?	○ Yes ◉ No	DATE	IDENTIFY PD NO. ETC.
C ARE THERE ANY PROPOSALS OR REPORTS OR OTHER DOCUMENTS RELATING TO THIS INVENTION?	○ Yes ◉ No	DATE	IDENTIFY
D HAS THE INVENTION BEEN USED INSIDE OR OUTSIDE THE COMPANY, OR DISCUSSED, DEMONSTRATED, OR OTHERWISE DISCLOSED OUTSIDE THE COMPANY (SUCH AS TO A VENDOR OR CUSTOMER?)	○ Yes ◉ No	DATE	TO/FOR WHOM (COMPANY/PERSON)

7. SALE

		ORDER NO.	ORDER DATE	DELIVERY DATE	DATE OFFERED OR PROPOSED
A HAS PRODUCT EMBODYING INVENTION OR MADE BY INVENTION BEEN PROPOSED, SOLD, OR OFFERED FOR SALE?	○ Yes ◉ No				
B IS PRODUCT EMBODYING INVENTION OR MADE BY INVENTION IN A DELIVERABLE ITEM?	○ Yes ◉ No	DELIVERY DATE			

HRL PROPRIETARY AND SENSITIVE (when completed)

Mary Chen 11/01/02 SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE	INVENTION DOCKET NO. RECEIVED HRL LABORATORIES, LLC 021101
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE	
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE	
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE	

READ AND UNDERSTOOD BY:

David Chow WITNESS NAME (TYPE)	David M. Chow 11/01/02 SIGNATURE DATE	MARKO SOKOLICH WITNESS NAME (TYPE)	11/1/02 SIGNATURE DATE

SEND COMPLETED DISCLOSURE DIRECT TO:
TECHNOLOGY INFORMATION OFFICE
ATTN: Joy Pavlow, MS RL55
HRL LABORATORIES, LLC
Telephone No - 5734

HRL PROPRIETARY AND SENSITIVE
(when completed)
INVENTION DISCLOSURE
THIS INVENTION DISCLOSURE IS MADE PURSUANT TO MY / OUR OBLIGATIONS TO HRL LABORATORIES, LLC

HRL LABORATORIES

8. SUMMARY OF THE INVENTION

A. GIVE A BRIEF DESCRIPTION OF YOUR INVENTION, PARTICULARLY POINTING OUT WHAT IS BELIEVED TO BE NOVEL (THE "HEART" OF WHAT IS NEW).

Heterojunction Bipolar Transistors

Thin and depleted emitter ledge passivation has been widely used in GaAs based HBT technologies. It effectively reduces base surface recombination current (e.g., W. Liu et al "Critical passivation ledge thickness in AlGaAs/GaAs heterojunction bipolar transistors", J. Vac. Sci. Technol. B 11(1), 1993, p.6-9). It has not been applied to InP based HBTs. Although InP based HBT technology is more advanced because of superior electron transport property in that material system, fabrication of InP based HBTs has not been developed as GaAs based HBT has for manufacturing purpose. More efforts in InP based HBTs have been focused upon demonstrating high frequency performance of self-aligned HBTs than reaching goals of higher yield and enhanced reliability. Therefore techniques of reaching those goals remain new.

B. EXPLAIN THE PURPOSE AND ADVANTAGES OF YOUR INVENTION. (WHAT WILL THE INVENTION DO BETTER THAN DONE PREVIOUSLY?)

Indium Phosphide

InP based HBT passivated with a thin depleted emitter ledge effectively reduces base surface recombination current near emitter-base junction, improves current gain and process control, therefore enhances device reliability. This is particularly important to scaled HBTs because extrinsic base surface recombination current often dominates the total base current. Surface-recombination mechanisms can modify base-region transport efficiency (D. P. Kennedy et al, Solid-State Electronics, 1961, Vol. 3, pp. 215-225). Thickness of ledge is critical in making the ledge working properly for surface passivation. However it can be designed properly and controlled well in process. The quality of the ledge can be monitored by effective area ratio and ledge CV measurements (P.J. Zampardi et al, " Methods for monitoring passivation ledges in a manufacturing environment", GaAs Mantech Conference, 2002, pp. 225-228). The length of the fully depleted ledge can be designed to reduce base contact recombination current. This new HBT will make HBTs' DC characterization more ideal without sacrificing RF performance. This new HBT structure will also enhances InP based HBT manufacturability because both thickness and length of the ledge can be controlled by conventional process and it has a good base contact process. This passivation layer also protects base layer (InGaAs or GaAsSb) from being attacked in sequential process steps. Therefore it can be applied to both InP based SHBT (single hetero-junction HBT) and DHBTs (double hetero-junction HBTs) including InP/GaAsSb/InP DHBTs. It provides more planer device structure and potential for new interconnect design. Therefore this device will enhance large scale circuit integration. This new HBT has multiple advantages and will have significant impacts to all InP based HBTs. It is easy to implement.

8. SUMMARY OF THE INVENTION (Continued)

C. IDENTIFY THE COMPANY OR OWNER PROGRAM OR PRODUCT LINE TO WHICH THE INVENTION APPLIES, AND THE EXPECTED VALUE TO THE PROGRAM OR PRODUCT LINE. ALSO IDENTIFY POTENTIAL COMMERCIAL APPLICATION OF THIS INVENTION, IF ANY.

HRL has high speed InP technology for advanced radar and space programs. Raytheon is a defense electronics contractor. This invention can be applied to airborne radar programs. It may find applications in on going government contract of HRL if it is suitable. This technology development is ready to go now. Beside government defense communication market potential commercial applications include 40Gb commercial products. Because this technique can have wide applications as stated above, and capable of enhancing manufacturability and reducing cost, it can have significant impact to InP based HBT production.

SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE
Mary Chen	11/01/02		
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE

INVENTION DOCKET NO.

READ AND UNDERSTOOD BY:

WITNESS NAME (TYPE)	SIGNATURE DATE	WITNESS NAME (TYPE)	SIGNATURE DATE
David Chow	David W. Chow 11/01/02	MARKO SOKOLICH	11/1/02

(EACH PAGE UPON WHICH INFORMATION IS ENTERED SHOULD BE SIGNED AND WITNESSED)

D. IDENTIFY THE PRIOR ART KNOWN TO YOU WHICH IS IMPROVED UPON OR DISPLACED BY YOUR INVENTION, AND STATE IN DETAIL, IF KNOWN, THE DISADVANTAGES OF THE CLOSEST PRIOR ART.

"InGaAs/InP Double-Heterostructure Bipolar Transistors With Near-Ideal β Versus Ic Characteristic" by R. N. Nottenburg et al (IEEE Electron Device Latter Vol. EDL-7, No. 11, 1986, pp.643-645) claimed their HBTs with high emitter injection efficiency at very low collector current is due to at least a factor 100 smaller surface recombination current. It claimed the results were obtained without attempt of junction edge passivation such as an emitter edge-thinning (i.e. emitter ledge). However their HBTs are of large emitter size: 16x40 to 44x100μm^2. Therefore it is obvious that external base surface recombination is not an issue in those devices. However the layer design and process may not be suitable for scaled InP based HBTs.

"Emitter edge-thinning effect on InGaAs/InP double-heterostructure-emitter bipolar transistor" by Yu-Huei Wu et al (Jpn. J. Appl. Phys. Vol. 34,1995, pp. 5908-5911) reported results with emitter edge-thinning design. It has a hetero-emitter composed of InP and InGaAs. According to the layer and device design the thickness of ledge can not be easily controlled in process. Ledge thickness is critical in making the ledge working properly for surface passivation (W. Liu et al, "Parasitic conduction current in the passivation ledge of AlGaAs/GaAs heterojunction bipolar transistors", Solid State Electronics, Vol. 35. No.7, pp.891-895, 1992). The new proposed InP based HBT provides emitter ledge design and process that enables easy control of ledge thickness with conventional processes.

Recently presented "Reliability implication of InGaP HBT emitter ledge dimension" by Even Yu et al (GaAs Reliability Workshop 2002, pp. 167-168) showed effects of various length of ledge, and gap between ledge and base contact to base current components. Some are resulted from un-intentional mis-alignment in photo -lithography. The exposed gap between ledge and base contact caused less than 100% surface passivation. In this invention the new HBT will not have those types of gaps. The ledge covers all space between emitter mesa and base contacts.

E. IF PRIOR ART EXISTS, EXPLAIN WHY YOUR INVENTION IS NOT OBVIOUS IN LIGHT OF THE PRIOR ART. CONSIDER SUCH FACTORS AS UNEXPECTED RESULTS, COMMERCIAL SUCCESS OF THE INVENTION, A LONG-FELT NEED THAT IS SATISFIED BY THIS INVENTION, FAILURE OF OTHERS WHO HAVE TRIED TO MAKE THIS INVENTION OR SATISFY THE NEED, COPYING OF YOUR INVENTION BY OTHERS, LICENSING OF YOUR INVENTION AND SKEPTICISM BY THOSE EXPERT IN THE TECHNICAL FIELD OF THE INVENTION ABOUT THE FEASIBILITY OF THE INVENTION.

Thin and depleted emitter ledge passivation technique has been widely used in GaAs based HBT technologies for reducing base surface recombination current near emitter-base junction. It has not been applied to InP base HBTs partially because it was believed that in comparison to GaAs based HBTs the depleted emitter ledge passivation effect may manifest less influences on current gain due to lower surface recombination velocity of InGaAs. Actually this is not true for p+ InGaAs which is the base layer of NPN HBTs. Fermi level pinned by high surface density states of InGaAs near 0.15V below conduction band of InGaAs. InGaAs has band gap of 0.7V. For p+ InGaAs the conduction band's bending in band diagram shows a field for minority carriers (electrons) to recombine near surface beside by diffusion through bulk base layer. Therefore InP based NPN HBTs are not immune from external base surface recombination especially for those scaled HBTs . However InP based HBTs have been scaled for high frequency performance. The base surface recombination current near emitter-base junction may increase particularly in those self-aligned HBTs. The need of fully depleted emitter ledge for surface passivation actually exists. Eventually this concept will be accepted. The self-aligned HBTs are for reducing base resistance. However if there is too small amount of overhang (which separates base contact and emitter mesa) the base surface and base contact recombination current may increase. On the other hand if there is too much undercut of emitter contact emitter resistance may increase. For better control of self-aligned InP based HBT process complicated processes including dummy emitter formation, SiON side wall, multiple coat and etch back of polyimide was used for emitter and base electrode formation (H. Shigematsu et al, IEEE Electron Device Letters, Vol. 16, No. 2, 1995, pp. 55-57) which is time consuming. The new non-self aligned HBT proposed in this invention avoided all these problems without increasing base resistance. The separation of base contacts and emitter mesa is controlled by ledge length and lithography. Today's photo lithography can bring base contacts as close to emitter edge as needed. It can minimize the base resistance. Emitter ledge should be easily detected by SEM (scanning electron microscope) analysis of device cross-section.

Mary Chen 11/01/02			INVENTION DOCKET NO.
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		RECEIVED HRL LABORATORIES, LLC
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		NOV 4 ...
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		021101
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		

READ AND UNDERSTOOD BY:

David Chow	David W. Chow 11/01/02	MARKO SOKOLICH	11/1/02
WITNESS NAME (TYPE)	SIGNATURE DATE	WITNESS NAME (TYPE)	SIGNATURE DATE

(EACH PAGE UPON WHICH INFORMATION IS ENTERED SHOULD BE SIGNED AND WITNESSED)

SEND COMPLETED DISCLOSURE DIRECT TO:
TECHNOLOGY INFORMATION OFFICE
ATTN: Joy Pavlow, MS RL55
HRL LABORATORIES, LLC
Telephone No - 5734

HRL PROPRIETARY AND SENSITIVE
(when completed)
INVENTION DISCLOSURE
THIS INVENTION DISCLOSURE IS MADE PURSUANT TO
MY / OUR OBLIGATIONS TO HRL LABORATORIES, LLC

HRL LABORATORIES

9. DETAILED DESCRIPTION

DESCRIBE YOUR INVENTION IN DETAIL, EXPLAINING THE STRUCTURE OF THE APPARATUS OR DEVICE, INCLUDING MATERIALS USED, SIZES AND DIMENSIONS AND HOW COMPONENTS ARE CONNECTED AND EXPLAINING THE METHOD OF PERFORMING THE INVENTION, INCLUDING EACH OF THE STEPS NEEDED TO COMPLETE THE METHOD. MULTIPLE EMBODIMENTS OF THE INVENTION SHOULD BE IDENTIFIED; HOWEVER, IF MORE THAN ONE EMBODIMENT IS DISCLOSED, IDENTIFY WHICH IS THE PREFERRED EMBODIMENT. USE ADDITIONAL SHEETS AS NECESSARY.

A. BE SURE THAT EACH SHEET IS DATED, AND SIGNED BY EACH INVENTOR AND TWO WITNESSES.

B. ATTACH COPIES OF DRAWINGS OR DETAILED REPORTS HELPFUL IN UNDERSTANDING HOW YOUR INVENTION WORKS.

C. IF YOUR INVENTION HAS BEEN TESTED, BRIEFLY SUMMARIZE THE TEST RESULTS WHICH CONFIRM THE FUNCTIONS AND ADVANTAGES LISTED IN 8 B ABOVE.

InP Based NPN HBT Passivated with Thin Depleted Emitter Ledge

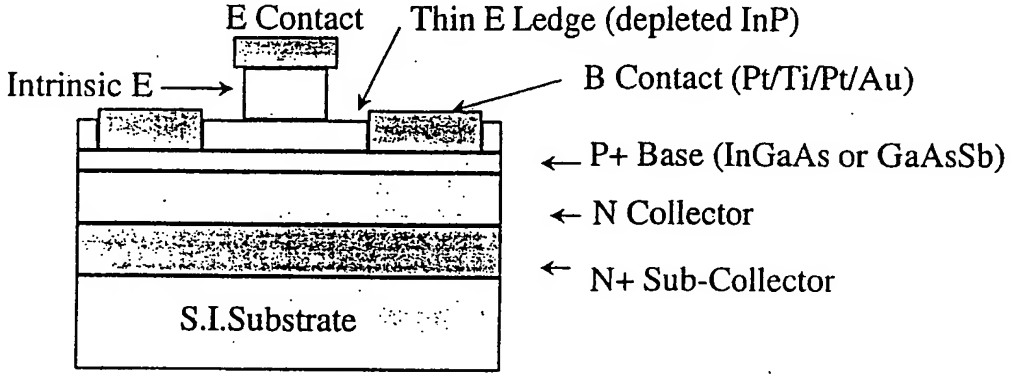


Fig. 1 Non-self-aligned HBT
passivated with fully depleted emitter ledge
between base contact and emitter mesa

SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE	INVENTION DOCKET NO.
Mary Chen	11/01/02			RECEIVED HRL LABORATORIES, LLC 021101
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE	
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE	
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE	

READ AND UNDERSTOOD BY:

WITNESS NAME (TYPE)	SIGNATURE DATE	WITNESS NAME (TYPE)	SIGNATURE DATE
David Chow 11/01/02	11/1/02	MARKO SOKOLICH	11/1/02

(EACH PAGE UPON WHICH INFORMATION IS ENTERED SHOULD BE SIGNED AND WITNESSED)

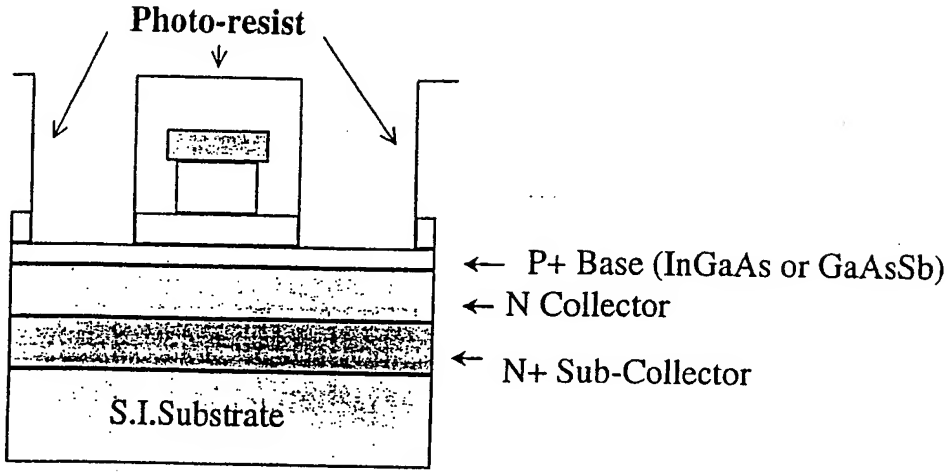


Fig.2 Photo-lithography for base contact.
Ledge layer is removed to expose P+ base.
Base contact will be deposited in the open area.

Mary Chen 11/01/02			INVENTION DOCKET NO.
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE	RECEIVED HRL LABORATORIES, LLC	
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE	021101	
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		

READ AND UNDERSTOOD BY:

David Chow	11/01/02	MARKO SOKOLICH	11/1/02
WITNESS NAME (TYPE)	SIGNATURE DATE	WITNESS NAME (TYPE)	SIGNATURE DATE

(EACH PAGE UPON WHICH INFORMATION IS ENTERED SHOULD BE SIGNED AND WITNESSED)

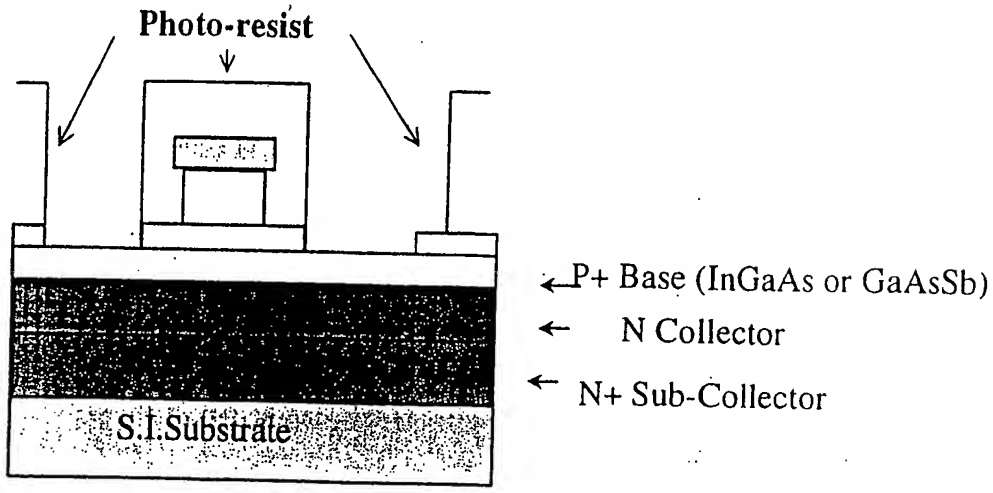


Fig.3 Alternative process: another level of lithography for wider base contact

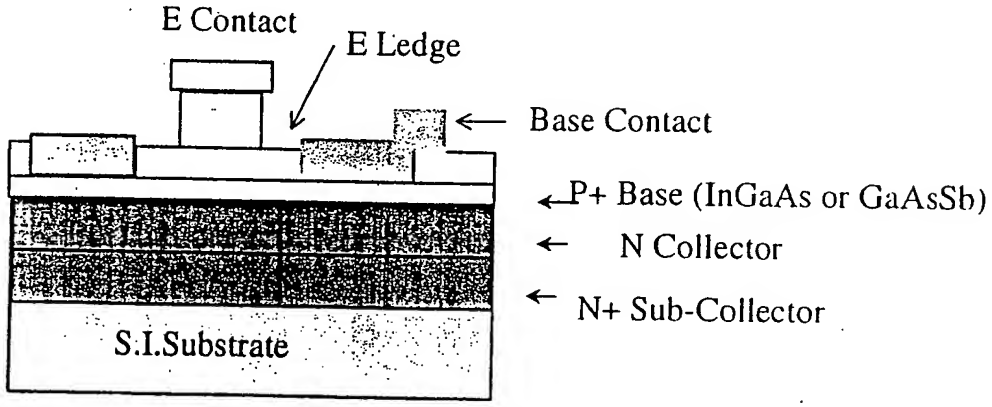


Fig.4 HBT with wider base contacts

Mary Chen 11/01/02			INVENTION DOCKET NO.
SIGNATURE OF INVENTOR DATE		SIGNATURE OF INVENTOR DATE	RECEIVED HRL LABORATORIES, LLC NOV 4 021101
SIGNATURE OF INVENTOR DATE		SIGNATURE OF INVENTOR DATE	
SIGNATURE OF INVENTOR DATE		SIGNATURE OF INVENTOR DATE	
SIGNATURE OF INVENTOR DATE		SIGNATURE OF INVENTOR DATE	

READ AND UNDERSTOOD BY:

David Chow	David K. Chow 11/01/02	MARKO SOKOLICH	11/1/02
WITNESS NAME (TYPE)	SIGNATURE DATE	WITNESS NAME (TYPE)	SIGNATURE DATE

(EACH PAGE UPON WHICH INFORMATION IS ENTERED SHOULD BE SIGNED AND WITNESSED)

Figure 1 shows a schematic of emitter and base part of InP based HBT with thin depleted emitter ledge. HBT layer structure from top down can be (type A, InAlAs emitter): n+ InGaAs (emitter cap), n+ AlInAs, n-AlInAs (emitter), n-InP (emitter ledge), p+ InGaAs or p+ GaAsSb base, n-InGaAs collector (SHBT if base is p+InGaAs), or n-InP collector if base is GaAsSb (DHBT), or quaternary (or chirped super-lattice) graded B-C with n-InP collector (DHBT with p+ InGaAs base), and n+ InP or InGaAs sub-collector. Emitter part can also be (type B, InP emitter): n+ InGaAs (emitter cap), n+ InP, n-InP (emitter), AlGaInAs (thin, etch stop layer), n-InP (emitter ledge). The rest of type B layer structure is the same as type A. In both cases emitter ledge is n-InP. N-InAlAs or N-InP emitter doping level is based upon requirements from device and circuit applications including collector current, emitter resistance and emitter-base capacitance. It could be in the range of mid-E17/cm^3 to 1E18/ cm^3. Emitter thickness should be thick enough so that the back-injection of holes into emitter is negligible. It could be around 1000Å. This includes the total thickness of emitter above ledge and ledge. The critical part is emitter ledge thickness. It has to be fully depleted to be able to serve as surface passivation layer. Otherwise parasitic conduction current in the passivation ledge will increase base contact recombination current (W. Liu et al, "Parasitic conduction current in the passivation ledge of AlGaAs/GaAs heterojunction bipolar transistors", Solid State Electronics, Vol. 35. No. 7, pp.891-895, 1992). It should reach a condition that surface depletion region (at top of ledge) and p/n junction depletion region (at bottom of ledge) touches each other, i.e., no-undepleted part in ledge exists. The depletion from p/n junction depletion region thickness varies with Vbe in operation and decreases under forward bias. Considering effects from possible doping level shift and/or growth rate shift (or mis-calibration of growth rate) during growth, and dielectric layer passivation on top of ledge (typical for HBT processing) ledge thickness should be designed less than surface depletion width. Therefore upper limit of the ledge thickness is mainly set by ledge performance. Lower limits of the ledge thickness include beta, emitter/base breakdown voltage, emitter/base capacitance and reliability since it is part of emitter layer. Emitter ledge is a thin layer (in the range of a few hundred angstroms) it needs to be well protected in the later processes.

In device process the emitter contacts can be formed first. Then layers from emitter cap layer down to layer above n-InP ledge will be etched by dry etch (e.g. ICP system with end point to monitor optical emission signal strength) or wet chemical selective etch with emitter contact as the mask. In type A layer structure etch goes through n+ InGaAs, n+ AlInAs, and n-AlInAs (emitter), stops on top of n-InP ledge; in type B layer structure: etch goes through n+InGaAs, n+ InP, n-InP (emitter) and thin AlGaInAs, stops on top of n-InP ledge. Then photo lithography will be performed for base contacts. For completely depleted emitter ledge base contacts can be brought as close to edge of emitter mesa as 3000 A (W. Liu et al, "Parasitic conduction current in the passivation ledge of AlGaAs/GaAs heterojunction bipolar transistors", Solid State Electronics, Vol. 35. No. 7, pp.891-895, 1992; and W. Liu et al "Theoretical comparison of base bulk recombination current and surface recombination current of a mesa AlGaAs/GaAs heterojunction bipolar transistor", Solid-State Electronics, Vol. 34, No.10, pp. 1119-1123, 1991) as required by reducing base contact recombination current. Even with emitter ledge passivation to reduce base surface recombination current the recombination current at base contacts would still limit device current gain. n-InP ledge layer exposed by lithography will be removed to expose p+ base. Etch should stop on top of p+ base layer (By ICP or wet chemical selective etch). Fig. 2 shows the profile after n-InP etch with base contact level mask. Then base contacts will be formed (evaporation and lift off). Base contact metal can be Pt/Ti/Pt/Au since this type of base contacts have been used not only for GaAs based HBTs, bust also InP/InGaAs based HBTs (S. Yamahata et al, GaAs IC Symposium, 1994, pp.345-348) and InP/GaAsSb based HBTs (C.R. Bolognesi et al, GaAs IC Symposium, 1999, pp. 63-66). The finished profile is shown in Fig.1: with depleted InP emitter ledge sitting between base contacts and emitter mesa. No base surface is exposed which is good technique for external base surface passivation. An alternative process is for wider base contacts if it is needed (at least on one side of emitter mesa). After base layer for base contact is exposed photo-resist should be removed. Another level of lithography can open wider base contact as shown in Fig.3. After base metal evaporation and lift off finished profile is shown in Fig.4. This could be useful for scaled device without increasing extrinsic base-collector capacitance. There should be no alignment problems for photo-lithography. HBTs with fully depleted emitter ledge will have reduced base surface recombination current, higher current gain, and lower base resistance because of good base contact process. Since external base surface is fully passivated and well protected from later processes this device should provide better reliability.

Mary Chen 11/01/02				INVENTION DOCKET NO.
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE	RECEIVED HRL LABORATORIES, LLC NOV 4 021101
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE	
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE	
SIGNATURE OF INVENTOR	DATE	SIGNATURE OF INVENTOR	DATE	

READ AND UNDERSTOOD BY:

David Chow		MARKO SOKOLICH	
WITNESS NAME (TYPE)	SIGNATURE DATE 11/01/02	WITNESS NAME (TYPE)	SIGNATURE DATE 11/1/02

(EACH PAGE UPON WHICH INFORMATION IS ENTERED SHOULD BE SIGNED AND WITNESSED)

SEND COMPLETED DISCLOSURE DIRECT TO:
TECHNOLOGY INFORMATION OFFICE
ATTN: Joy Pavlow, MS RL55
HRL LABORATORIES, LLC
Telephone No - 5734

HRL PROPRIETARY AND SENSITIVE
(when completed)
INVENTION DISCLOSURE
THIS INVENTION DISCLOSURE IS MADE PURSUANT TO
MY / OUR OBLIGATIONS TO HRL LABORATORIES, LLC

HRL LABORATORIES

There are various methods that can monitor passivation ledges. It is generally sufficient to compare effective area ratio of a long ledge device to a short ledge device (P.J. Zampardi et al, " Methods for monitoring passivation ledges in a manufacturing environment", GaAs Mantech Conference, 2002, pp. 225-228). Similarly beta ratio of device with longer ledge to shorter ledge is a good parameter for ledge Passivation evaluation. Ratio near 1 is expected for devices with a good ledge. Experiments of comparing base current ideality factor of HBTs with and without passivation, with same emitter length but various emitter width can also provide information of efficiency of surface passivation (William Liu, Handbook of III-V Heterojunction Bipolar Transistors, §3-6 Surface current ideality factor, pp. 169-179).

J Mary Chen 11/01/02			INVENTION DOCKET NO.
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		RECEIVED HRL LABORATORIES, LLC
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		021101
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		
SIGNATURE OF INVENTOR DATE	SIGNATURE OF INVENTOR DATE		

READ AND UNDERSTOOD BY:

David Chow	11/01/02	MARKO SOKOLICH	11/1/02
WITNESS NAME (TYPE)	SIGNATURE DATE	WITNESS NAME (TYPE)	SIGNATURE DATE

(EACH PAGE UPON WHICH INFORMATION IS ENTERED SHOULD BE SIGNED AND WITNESSED)

D. R. Allemeier, General Counsel

February 10, 2003

DISKETTE ENCLOSED

HRL LABORATORIES

BY COURIER

Richard P. Berg
Ladas & Parry
5670 Wilshire Blvd., Suite 2100
Los Angeles, CA 90036-5679

Reference **HRL No. 021001, "All-Optical Delay Generator for PPM Communications Based on a Non-Linear Waveguide with a Chirped DBR"**
(Inventor: Stanislav I. Ionov)
HRL No. 021007, "Non-Self-Aligned Heterojunction Bipolar Transistors"
(Inventor: Charles Fields)
HRL No. 021009, "A Quartz Nanoresonator for Board-Band Filter Applications with Tailored and Continuously Distributed Electrodes"
(Inventor: Randy Kubena)
HRL No. 021101, "InP Based NPN HBT Passivated with a Thin Depleted Emitter Ledge"
(Inventor: Mary Chen)
HRL No. 021108, "Structure and Method for a Low Cost Adaptive Beam Forming System Using a Tunable Impedance Surface"
(Inventors: Daniel Sievenpiper, Jim Schaffner, Greg Tangonan)

Dear Rich,

Enclosed are copies of the above-referenced Invention Disclosures HRL Laboratories is assigning to you. A CD ROM with soft copies of same is enclosed.

With regard to HRL No. 021007, you and HRL's Information Technology Office need to get the right inventors on this invention disclosure. File a provisional first, preferably close to December 2003 due to potential "on sale" to Raytheon, but allowing time to validate process.

On HRL No. 021101, use the "Emitter Ledge" phrase to avoid prior art.

On HRL No. 021108, please ensure that this invention is not limited to the simple algorithm included in the disclosure and look at using other types of antennas.

If any reason for expedited handling is revealed in these Invention Disclosures, please contact me immediately at (310) 317-5851.

Sincerely,

Dan Allemeier
General Counsel

DRA/jp

HRL Laboratories, LLC
3011 Malibu Canyon Road • Malibu, CA 90265-4797
Phones: (310) 317-5000 • Fax: (310) 317-5483

LADAS & PARRY Intranet

Enter OLN/Search Criteria: Due Dates Go

Docket System Main Page | Search for Cases | Ladas.com | US Patent Office Site | Issues/Enhancements List | Recent Timekeeper

Search Cases Search Debit Notes Search Parties

Patent Tax Pmts | Timekeeper | File Location | Detail | Due Dates | Debit Notes | Assoc. Charges | Corres. List | Select Another Option Go

Order Ltr No. 620692-1 Client: HRL Laboratories, LLC Code: HRL Labs Cl Ref: 021101

Title/Mark/Matter: A Semiconductor Structure for a Heterojunction Bipolar Transistor... Country: US

Service Render Date	Billing Prof	Hours Billed	Or Bill Amt: (in $)	Hours Expended	Complid?
9/26/2006	ak				Yes

Description: Select Preformatted Option or Enter One Below

Customize Description:

Activity Code: Select Preformatted Option Below or Leave Blank

Add New Timekeeper Entry

Start a New Timekeeper Stopwatch - Begin Stopwatch

This matter has 48 Timekeeper Records

Displaying from 1 to 48

Service Date	Who?	Description	Hours Exp.	%	Hours Bill.	Amt	Status
08/12/2003	SJJ	Our fee for filing new U.S. provisional application (Special Client Rate)	0.00	0%	0.00	$150.00	PUF 106534 08/29/2003
08/11/2003	RAS	Final changes to application, prepare final version for filing as a provisional application	1.50	100%	1.50	$450.00	PUF 106534 08/29/2003
08/04/2003	RAS	Complete revisions to draft of application, revise claims, draft memo to inventor and send to inventor by fax for review	4.00	100%	4.00	$1200.00	PUF 106534 08/29/2003
08/03/2003	RAS	Revise drawings in patent application and add drawings to better illustrate the fabrication process	4.00	100%	4.00	$1200.00	PUF 106534 08/29/2003
08/01/2003	RAS	Meeting with inventor at HRL, begin revising appication based on discussion with inventor, elaborate and clarify background of the invention	5.00	100%	5.00	$1500.00	PUF 106534 08/29/2003
07/31/2003	RAS	Review disclosure in preparation for meeting with inventor	2.50	100%	2.50	$750.00	PUF 106534 08/29/2003
07/21/2003	TB	Preparation of patent application/phone call with inventor	0.50	0%	0.00	$110.00	Currently Unbilled
07/15/2003	TB	Preparation of patent application	1.00	0%	0.00	$220.00	Currently Unbilled
07/11/2003	TB	Preparation of patent application	3.70	0%	0.00	$814.00	Currently Unbilled
07/03/2003	TB	Preparation of 3rd draft of patent application	1.80	0%	0.00	$396.00	Currently Unbilled
07/01/2003	TB	Preparation of 3rd draft	3.30	0%	0.00	$726.00	Currently Unbilled
06/30/2003	TB	Preparation of 3rd draft	0.90	0%	0.00	$198.00	Currently Unbilled
06/24/2003	TB	Meeting with inventor; preparation of 3rd draft of patent application	3.30	0%	0.00	$726.00	Currently

06/24/2003	TB	Meeting with inventor; preparation of 3rd draft of patent application	3.30	0%	0.00	$726.00	Unbilled
06/23/2003	TB	Preparation of patent application	2.40	0%	0.00	$528.00	Currently Unbilled
06/20/2003	TB	Preparation of 2nd draft of patent application	4.40	0%	0.00	$968.00	Currently Unbilled
06/19/2003	TB	Preparation of 2nd draft	6.70	0%	0.00	$1474.00	Currently Unbilled
06/18/2003	TB	preparation of 2nd draft	2.70	0%	0.00	$594.00	Currently Unbilled
06/17/2003	TB	Preparation of 2nd draft	2.30	0%	0.00	$506.00	Currently Unbilled
06/16/2003	TB	Preparation of 2nd draft	0.70	0%	0.00	$154.00	Currently Unbilled
06/13/2003	TB	Preparation of 2nd draft	2.10	0%	0.00	$462.00	Currently Unbilled
06/10/2003	TB	Preparation of patent application	2.10	0%	0.00	$462.00	Currently Unbilled
06/09/2003	TB	Preparation of patent application	0.80	0%	0.00	$176.00	Currently Unbilled
06/06/2003	TB	Preparation of patent application	0.70	0%	0.00	$154.00	Currently Unbilled
05/30/2003	TB	Meeting with inventor	2.50	0%	0.00	$550.00	Currently Unbilled
05/27/2003	TB	Preparation of patent application	1.50	0%	0.00	$330.00	Currently Unbilled
05/22/2003	RAS	Review application and provide comments	0.75	100%	0.75	$221.00	PUF 106534 08/29/2003
05/21/2003	TB	Preparation of patent application	3.00	100%	3.00	$660.00	PUF 106534 08/29/2003
05/15/2003	TB	Preparation of patent application	1.40	0%	0.00	$308.00	Currently Unbilled
05/13/2003	TB	Preparation of patent application	2.50	0%	0.00	$550.00	Currently Unbilled
05/07/2003	TB	Preparation of patent application	0.80	0%	0.00	$176.00	Currently Unbilled
05/02/2003	RAS	Review draft of patent application	0.40	100%	0.40	$118.00	PUF 106534 08/29/2003
04/25/2003	TB	Preparation of patent application	2.50	100%	2.50	$550.00	PUF 106534 08/29/2003
04/24/2003	TB	Preparation of patent application	3.00	0%	0.00	$660.00	Currently Unbilled
04/22/2003	TB	Preparation of patent application	3.00	0%	0.00	$660.00	Currently Unbilled
04/22/2003	TB	Phone conversation with inventor	0.30	100%	0.30	$66.00	PUF 106534 08/29/2003
04/21/2003	TB	Preparation of patent application	2.00	0%	0.00	$440.00	Currently Unbilled
04/09/2003	TB	Preparation of patent application	4.00	0%	0.00	$880.00	Currently Unbilled
04/08/2003	TB	Preparation of patent application	3.60	0%	0.00	$792.00	Currently Unbilled
04/07/2003	TB	Preparation of patent application	4.40	0%	0.00	$968.00	Currently Unbilled
04/04/2003	TB	Preparation of patent application	2.60	0%	0.00	$572.00	Currently Unbilled
04/03/2003	TB	Preparation of patent application	0.90	0%	0.00	$198.00	Currently Unbilled
03/20/2003	TB	Preparation of patent application	2.30	0%	0.00	$506.00	Currently Unbilled
03/17/2003	TB	Preparation of Patent Application	2.10	0%	0.00	$462.00	Currently Unbilled
03/14/2003	TB	Preparation of patent application	1.30	0%	0.00	$286.00	Currently Unbilled
03/13/2003	TB	Preparation of patent application	0.00	0%	0.00	$0.00	Currently Unbilled
03/13/2003	TB	Preparation of patent application	3.50	0%	0.00	$770.00	Currently Unbilled
02/28/2003	TB	Reviewing disclosure	1.00	100%	1.00	$220.00	PUF 106534 08/29/2003
							PUF

02/28/2003	TB	Meeting with Inventor	1.00	100%	1.00	$220.00	106534 08/29/2003

Hours Expended - 106.75 | Hours Billed - 25.95 | Amt Billed - $25081.00

Back | Docket System Main Page | Intranet Main Page | Forward

Bethea, Thomas Jr.

From: Mary Chen
Sent: Friday, April 11, 2003 4:18 PM
To: Bethea, Thomas Jr.
Subject: Re: 021101 Status

Thomas,

(1) I saw 2 questions before claims part. Are you referring to lithography of Fig.3 ("second level of lithography")? It is an alternative of Fig.2: if the finished device will have at least one wider base electrode as shown in Fig.4 (which is wider than the device in Fig.1).

(2) Base contact lithography is to define base metal area by photo-resist. Base contact etch is performed with the photo-resist mask. Then it follows by base metal deposition (evaporation). Metal falls every where on wafer surface: either in the photo-resist openings or on top of photo-resist. The part that in on top of photo-resist is removed by lifted-off (gone with photo-resist). The wanted part stays after this lift-off process.

I'll talk to you later. Thanks. Have a nice weekend.

Mary

"Bethea, Thomas Jr." wrote:

> Mary,
> Here is a rough draft of the application. I'm going to have to add language
> regarding the thicknesses each layer of the HBT (types A and B). --in the
> examples you gave me, they didn't include the thicknesses of the collector
> and subcollector -- I'm also going to add claims directed to the particular
> types, including materials and layer thicknesses. I will include all of
> this in a more formal draft that I will fax to you in the next few days.
>
> <<app>>
>
> Regards,
>
> Thomas Bethea, Jr.
> Ladas & Parry
> 5670 Wilshire Boulevard
> Los Angeles, CA 90036
> Tel: (323) 934-2300
> Fax: (323) 934-0202
>
> ***The information herein is confidential and may be privileged. Access to
> this email by anyone besides the intended recipient is not authorized. If

> you are not the intended recipient, then disclosure, copying, or use of the
> contents of this email is prohibited. If you are not the intended
> recipient, please notify me immediately by a collect call or by email and
> destroy the email you have received.***
>
> ----------
> Name: app.DOC
> app.DOC Type: WINWORD File (application/msword)
> Encoding: base64
> Description: app

Bethea, Thomas Jr.

From: Mary Chen
Sent: Monday, April 14, 2003 8:53 AM
To: Bethea, Thomas Jr.
Subject: Re: 021101 Status

Thomas,
I just realized that in your questions about "second level metal" about deviced finished as shown in Fig.4: it does take another level lithography (Fig.3) for the base metal after area for base contact area is exposed by etch (Fig.2). This is unlike device finished as Fig.1: etch down to base layer and forming base contact metal shares one level of lithography (Fig.2). Talk to you later. Thanks.

Mary

"Bethea, Thomas Jr." wrote:

> Mary,
> Here is a rough draft of the application. I'm going to have to add language
> regarding the thicknesses each layer of the HBT (types A and B). --in the
> examples you gave me, they didn't include the thicknesses of the collector
> and subcollector -- I'm also going to add claims directed to the particular
> types, including materials and layer thicknesses. I will include all of
> this in a more formal draft that I will fax to you in the next few days.
>
> <<app>>
>
> Regards,
>
> Thomas Bethea, Jr.
> Ladas & Parry
> 5670 Wilshire Boulevard
> Los Angeles, CA 90036
> Tel: (323) 934-2300
> Fax: (323) 934-0202
>
> ***The information herein is confidential and may be privileged. Access to
> this email by anyone besides the intended recipient is not authorized. If
> you are not the intended recipient, then disclosure, copying, or use of the
> contents of this email is prohibited. If you are not the intended
> recipient, please notify me immediately by a collect call or by email and
> destroy the email you have received.***
>

```
>    ------------------------------------------------------------------------
>                    Name: app.DOC
>     app.DOC        Type: WINWORD File (application/msword)
>                 Encoding: base64
>            Description: app
```

Salaises, Victor

From: Mary Chen [mychen@hrl.com]
Sent: Monday, April 21, 2003 11:41 AM
To: la_mail@ladasparry.com
Subject: 021101 Draft (for Thomas Bethea)

Thomas,

I read through most part of your first draft. I have not received your fax yet.

(A) I sent you a few messages about your questions. I hope that we'll have a chance to talk about that part soon because it relates to claims part.

(B) Among other things:

(1) "Intrinsic emitter" on figure 1 refers to emitter under emitter contact, not only includes emitter layers above depleted layer. Intrinsic emitter includes more than emitter mesa. It includes all layers on top of p+ base.

(2) The part of depleted emitter layer outside of intrinsic emitter is emitter ledge. The part under emitter contact is still part of intrinsic emitter.

These 2 items will take a few changes (for most of the places they are referred).

(3) About SHBT and DHBTs I re-write it as the following (2nd & 3rd paragraph under "DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS on page 5 of your draft:

Type A can be either SHBTs or DHBTs. It comprises an InAlAs/InP emitter having an n+ InGaAs emitter cap and an n+ AlInAs, n- AlInAs emitter and n-InP emitter; a p+ InGaAs or p+ GaAsSb base; an n- InGaAs or n-InP collector. Both SHBTs and DHBTs can have either p+ InGaAs or p+ GaAsSb base. SHBTs can have either a p+ InGaAs or p+ GaAsSb base, and an n-InGaAs collector. DHBTs can have either a p+ GaAsSb base and an n- InP collector; or a p+ InGaAs base, a quaternary (or chirped super-lattice) graded B-C with n-InP collector. The layer above the substrate could be an n+ InP or InGaAs sub-collector.
Type B comprises an InP emitter having an n+ InGaAs emitter cap and an n+ InP, n-InP emitter with a thin AlGaInAs (etch stop layer) inserted near the bottom of n-InP emitter (above InP emitter ledge). The rest of type B layer structure is the same as type A.

(4) There a few other places (relatively minor) that I like to talk to you too.

Please let me informed of your approximate schedule about this invention disclosure. I'll call you soon. Thanks.

Mary

****
TRANSMISSION REPORT
****

(FRI) MAY 23 2003 14:06
LADAS & PARRY - L. A. 13239340202

DOCUMENT #	TIME STORED	TIME SENT	DURATION	PAGE(S)	MODE	RESULT
4800000-577	5. 23 14:02	5. 23 14:02	3' 35"	7	ECM	OK

DESTINATION	DST. TEL #
13103175152	13103175152

FILE COPY

LADAS & PARRY
FACSIMILE TRANSMITTAL

5670 Wilshire Boulevard, Suite 2100
Los Angeles, California 90036-5679
Telephone: (323) 934-2300
Facsimile: (323) 934-0202

DELIVER TO: Mary Chen

COMPANY: HRL Laboratories

FAX NUMBER: 310-317-5152

FROM: Thomas Bethea, Jr.

DATE: 5/23/03

TOTAL NO. OF PAGES (INCLUDING THIS PAGE): [redacted]

OPERATOR: _____ **CLIENT:** _____

SUBJECT: Invention drawings

REMARKS:

If transmission incomplete, please call (323) 934-2300

* * * COMMUNICATION RESULT REPORT (JUN. 20. 2003 1:35PM) * * *

TTI LADAS & PARRY L. A.

ILE MODE	OPTION	ADDRESS (GROUP)	RESULT	PAGE
592 MEMORY TX		13103175152	OK	31/31

FILE COPY

REASON FOR ERROR
E-1) HANG UP OR LINE FAIL
E-2) BUSY
E-3) NO ANSWER
E-4) NO FACSIMILE CONNECTION

ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

Ladas & Parry
Los Angeles Office

Memorandum

To: Mary Chen
From: Thomas Bethea
Date: June 20, 2003
Subject: 2nd Draft of Patent Application for "InP Based NPN HBT Passivated with a Thin Depleted Emitter Ledge"
HRL PD 021101 (L&P 620692)

Dear Inventor:

ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

Ladas & Parry
Los Angeles Office

Memorandum

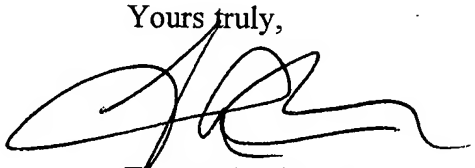
To: Mary Chen
From: Thomas Bethea
Date: July 3, 2003
Subject: 3rd Draft of Patent Application for "InP Based NPN HBT Passivated with a Thin Depleted Emitter Ledge"
HRL PD 021101 (L&P 620692)

Dear Inventor:

Presented is a 3rd draft of a patent application complete with a set of claims. Please review the specification and the claims.

If you would like, I can travel to HRL to meet with you in person to discuss your invention and this draft application. Otherwise, you can contact me by phone at 323-934-2300, by fax at 323-934-0202, or by email at tbethea@ladasparry.com. Thank you for your time and consideration.

Yours truly,



Thomas Bethea, Jr.
LADAS & PARRY

Encl.: 3rd Draft of Application for HRL PD 021101

ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

Bethea, Thomas Jr.

From: Mary Chen
Sent: Tuesday, July 8, 2003 9:50 AM
To: Bethea, Thomas Jr.
Subject: Re: 021101

Thomas,

I got your FAX (from Dan's site) last Thursday.

I looked at the figures you e-mailed me: Figures2 actually shows Fig.3, Figures3 shows Fig.1. There are a few things (beside errors still left in figures, e.g. what is the feature above 102 in Fi.1? Also Fig. 6 collector contact is still on top of collector which is wrong, it should be on top of sub-collector) I need to discuss with you. There is a layer 140 in most of the figures: optional base p type spacer. For best performance base contacts sit on top of p+ base layer 130 instead of on lower doped p base spacer. The easiest way may be not showing layer 140 in most figures (except ones showing layer structure but not with detailed device profiles).

What does your schedule look like this week? Can you come here so that I can talk to you? Please let me know what time is good for you. Thanks.

Mary Chen (310-317-5736)

"Bethea, Thomas Jr." wrote:

> <<figures>> <<figures2>> <<figures3>> <<app>>
>
> Regards,
>
> Thomas Bethea, Jr.
> Ladas & Parry
> 5670 Wilshire Boulevard
> Los Angeles, CA 90036
> Tel: (323) 934-2300
> Fax: (323) 934-0202
>
> ***The information herein is confidential and may be privileged. Access to
> this email by anyone besides the intended recipient is not authorized. If
> you are not the intended recipient, then disclosure, copying, or use of the
> contents of this email is prohibited. If you are not the intended
> recipient, please notify me immediately by a collect call or by email and
> destroy the email you have received.***
>
> > ----------

****
TRANSMISSION REPORT
****

(MON) AUG 4 2003 21:08
LADAS & PARRY - L. A. 13239340202

DOCUMENT #	TIME STORED	TIME SENT	DURATION	PAGE(S)	MODE	RESULT
4800000-848	8. 4 20:54	8. 4 20:54	13' 33"	27	ECM	OK

DESTINATION	DST. TEL #
13103175121	13103175121

LADAS & PARRY

Los Angeles Office
5670 Wilshire Blvd. 21st Floor
Los Angeles, California 90036

Fax: (323) 934-0202
Phone: (323) 934-2300

FAX COVER SHEET

To: HRL Laboratories **Attention: Mel Kyle**

From: Ross A. Schmitt **Fax # 310-317-5121**

Date: August 4, 2003 **Pages: 27**
(Including this page)

Subject: Final Draft of Provisional Application For HRL PD 021101

MESSAGE:

Mel:

Please direct the enclosed final draft of the this patent application for HRL PD 021101 and the associated cover memo to Mary Chen as soon as possible, since she would like to file this application as soon as possible. Thanks

Ross Schmitt

****
TRANSMISSION REPORT
****

(WED) AUG 6 2003 19:04
LADAS & PARRY - L. A. 13239340202

DOCUMENT #	TIME STORED	TIME SENT	DURATION	PAGE(S)	MODE	RESULT
4800000-902	8. 6 18:49	8. 6 18:49	14' 23"	28	ECM	OK

DESTINATION	DST. TEL #
13103175121	13103175121

LADAS & PARRY
Los Angeles Office
5670 Wilshire Blvd. 21st Floor
Los Angeles, California 90036

FAX COVER SHEET

Fax: (323) 934-0202
Phone: (323) 934-2300

To: HRL Laboratories **Attention:** Mel Kyle

From: Ross A. Schmitt **Fax #** 310-317-5121

Date: August 6, 2003 **Pages:** 28 (Including this page)

Subject: Updated Final Draft of Provisional Application For HRL PD 021101

MESSAGE:

Mel:

Please direct the enclosed final draft of the this patent application for HRL PD 021101 and the associated cover memo to Mary Chen as soon as possible, since she would like to file this application as soon as possible.

Also, please direct a copy of the application and the associated cover memo to Dan for his review and approval so that we can, if possible, [illegible]

Schmitt, Ross

From: Dan Allemeier
Sent: Tuesday, August 12, 2003 8:54 AM
To: Ross Schmitt
Cc: Kyle, Marianne; Virginia J Pavlow
Subject: HRL Docket # 021101

Ross here are my comments to HRL #021101

1. First I assume the edit marks will be corrected
2. Page 2, lines 12 14, this is not a sentence seems to missing a verb.
3. Page 3, line 8, change comprises to comprise both time it is used on line 8 as the subjects are plural so the verb should be plural. Same comment page 9, line 13 and page 10, line 7.
4. Page 3, line 30, change use to used .
5. Page 4, line 4, change FIG. 1 to FIG. 3 .
6. Page 4, line 8, review the three hyphenated word for spelling. I think unintentional and misalignment are not hyphenated. Also, photolithography is not hyphenated; see, page 12, line 31.
7. Page 7, lines 25 26, part of the deleted FIGs. 7 does not appear to be deleted.
8. Page 8, line 19, change extrinsic region 152 to extrinsic region 154 .
9. Page 9, line 19, change 265 to 260 .
10. Page 9, line 24, after 262, insert and .
11. Page 10, line 8, check the punctuation after 154 . Looks like a period in the faxed copy I received.
12. Page 10, line 9, insert 150, 250 after emitter ledge layer .
13. Page 10, line 17, insert 154, 254 after extrinsic region .
14. Page 10, line 18, it appears the deleted phrase in the region underneath the emitter should also include for deletion the remainder of the phrase, mesa 160, 260
15. Page 10, last paragraph beginning at middle of page: what about the etch stop layer, 266? There is no reference to this, even though it is in FIG 4B. Same comment, page 11, lines 11 13. See page 12, line 4, where the etch stop layer is referenced.
16. Page 11, line 3, do we need to say well-protected ? Isn't saying protected enough?
17. Page 11, lines 21 23, the sentence starting As discussed above& does not make sense to me. From what I could tell the extrinsic region 154 is a part of the emitter ledge layer 150, so I am not sure how the emitter ledge layer 150 could be less than the depletion layer thickness in the fully extrinsic region 154 .
18. Page 11, line 27, insert 130 after collector layer .
19. Page 13, line 2, should lithography be photolithography ?

20. Page 15, line 15, is should also be to indefinite, implying that the invention may not proved reliability.

21. Page 16, claim 1, there is no reference to a substrate in independent claim 1 or any of its dependent claims. Should there be? See claim 12.

22. Page 16, claim , should there be a reference to any contact between the various layers?

23. Page 16, claim 1, line 10, is it necessary to include the limitation etched ?

24. Page 17, claim 12, line 28 there appears to be no order for the collector layer and a base layer .